

## CLAIMS

1        1. A method for enabling a server configured with a plurality of virtual servers to par-  
2        ticipate in a plurality of private network address spaces and service requests within those  
3        address spaces, the method comprising the steps of:  
4                associating each virtual server with an IPspace having one or more addresses as-  
5        ssigned to one or more network interfaces of the virtual server;  
6                tagging each network interface with a first IPspace identifier (ID);  
7                providing the virtual server with one or more routing tables that control routing  
8        operations for requests processed by the virtual server; and  
9                applying the first IPspace ID to translation procedures that enable selection of a  
10       current virtual server context used to process an incoming request and an appropriate  
11       routing table used to process an outgoing request.

1        2. The method of Claim 1 wherein the server is a filer and wherein the virtual server is a  
2        virtual filer (vfiler).

1        3. The method of Claim 2 wherein the step of applying comprises the step of employing  
2        an incoming path translation procedure.

1        4. The method of Claim 3 wherein the step of employing comprises the steps of:  
2                receiving the incoming request at the network interface, the incoming request hav-  
3        ing a destination address;  
4                searching a list of addresses contained in an interface network structure for an ad-  
5        dress that matches the destination address of the incoming request, the interface network  
6        structure storing the first IPspace ID; and  
7                upon finding a match, following a first pointer of the interface network structure  
8        to an interface address structure having a back link pointer that references a vfiler context  
9        structure storing a second IPspace ID.

1 5. The method of Claim 4 wherein the step of employing further comprises the steps of:  
2       comparing the first IPspace ID with the second IPspace ID; and  
3       selecting the current vfile context to process the incoming request when the first  
4 IPspace ID matches the second IPspace ID.

1 6. The method of Claim 5 wherein the step of employing further comprises the step of  
2 configuring a second pointer of a process block data structure to reference the current  
3 vfile context to thereby qualify the request for subsequent processing in the filer.

1 7. The method of Claim 6 wherein the subsequent processing comprises one of searches  
2 and boundary checks needed to verify that the vfile is allowed to access requested stor-  
3 age resources.

1 8. The method of Claim 3 wherein the step of applying comprises the step of employing  
2 an outgoing path translation procedure.

1 9. The method of Claim 8 wherein the step of employing comprises the steps of:  
2       issuing the outgoing request from a vfile;  
3       determining whether the request requires route calculation; and  
4       if route calculation is required, using a routing table pointer of the current vfile  
5 context to choose the appropriate routing table of the vfile to process the outgoing re-  
6 quest.

1 10. The method of Claim 9 wherein the step of choosing comprises the steps of:  
2       performing a lookup operation to the appropriate routing table;  
3       determining over which output interface the outgoing request should be for-  
4 warded; and  
5       forwarding the request to the output interface.

1 11. A system adapted to enable a file server configured with a plurality of virtual servers  
2 to participate in a plurality of private network address spaces and service requests within  
3 those address spaces, the system comprising:

4       a network adapter including at least one network interface configured to receive  
5 an incoming request from the network and to forward an outgoing request over the net-  
6 work, the network interface an address and having a first IPspace identifier (ID) that  
7 binds the interface to an IPspace;

8       a plurality of routing tables maintained by the virtual servers to control routing  
9 operations for requests processed by the virtual servers;

10       an operating system comprising networking code that uses a destination address  
11 of the incoming request and the first IPspace ID to select a current virtual server to proc-  
12 ess the incoming request, the networking code further using a routing table pointer of the  
13 current virtual server to select an appropriate routing table if a routing operation is re-  
14 quired for the outgoing request; and

15       a processor coupled to the network adapter and configured to execute the operat-  
16 ing system to thereby invoke network and storage access operations in accordance with  
17 translation procedures associated with incoming and outgoing requests.

1 12. The system of Claim 11 wherein the file server is a filer and wherein the virtual serv-  
2 ers are virtual filers (vfilers).

1 13. The system of Claim 12 wherein the operating system is a storage operating system.

1 14. The system of Claim 13 further comprising a memory adapted to maintain various  
2 data structures that cooperate to provide an IPspace database that stores configuration in-  
3 formation used to select the current vfiler.

1 15. The system of Claim 14 wherein the various data structures comprise:

2       an interface network (ifnet) structure associated with the network interface;

3           an interface address (ifaddr) structure coupled to the ifnet structure and represent-  
4       ing the address of the interface;  
5           a vfiler context structure coupled to the ifaddr structure; and  
6           a process block (proc) structure coupled to the vfiler context structure.

1       16. The system of Claim 15 wherein the ifnet structure includes configuration informa-  
2       tion such as a first pointer referencing the ifaddr structure for the address assigned to the  
3       network interface and the first IPspace ID of the interface.

1       17. The system of Claim 16 wherein the ifaddr data structure includes a back link pointer  
2       that references the vfiler context structure associated with the address.

1       18. The system of Claim 17 wherein the vfiler context structure contains configuration  
2       information needed to establish the current vfiler, the configuration information including  
3       a second IPspace ID and the routing table pointer.

1       19. The system of Claim 18 wherein the proc data structure represents a context of a pro-  
2       cess thread executing on the filer and contains a second pointer referencing the current  
3       vfiler.

1       20. Apparatus for enabling a filer configured with a plurality of virtual filers (vfilers) to  
2       participate in a plurality of private network address spaces and service requests within  
3       those address spaces, the apparatus comprising:

4           means for associating each vfiler with an IPspace having one or more addresses  
5       assigned to one or more network interfaces of the vfiler;

6           means for tagging each network interface with a first IPspace identifier (ID);

7           means for providing the vfiler with one or more routing tables that control routing  
8       operations for requests processed by the vfiler; and

9 means for applying the first IPspace ID to translation procedures that enable se-  
10 lection of a current vfiler context used to process an incoming request and an appropriate  
11 routing table used to process an outgoing request.

1 21. A computer readable medium containing executable program instructions for ena-  
2 bling a filer configured with a plurality of virtual filers (vfilers) to participate in a plural-  
3 ity of private network address spaces and service requests within those address spaces,  
4 the executable program instructions comprising program instructions for:

5 associating each vfiler with an IPspace having one or more addresses assigned to  
6 one or more network interfaces of the vfiler;

7 tagging each network interface with a first IPspace identifier (ID);

8 providing the vfiler with one or more routing tables that control routing operations  
9 for requests processed by the vfiler; and

10 applying the first IPspace ID to translation procedures that enable selection of a  
11 current vfiler context used to process an incoming request and an appropriate routing ta-  
12 ble used to process an outgoing request.

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